

of this collagen protein was found to be identical to the predicted amino acid sequence, starting at amino acid number 66, of the *M. incognita* collagen Lemmi 5 cDNA clone (Gene 151:237-242). A putative subtilisin-like protease recognition site occurred immediately upstream of the region of amino acid homology between LEMMI 5 and the N-terminal sequence of the 76 kDa collagen protein. These data support previous speculation about the existence of this novel method of collagen maturation and provide further evidence that this mechanism has been conserved during nematode evolution. Expression of the Lemmi 5 gene was transcriptionally regulated. Lemmi 5-specific transcripts were present in females but not in eggs or second-stage juveniles. Lemmi 5 analogs were present in four *Meloidogyne* species, but not in *Caenorhabditis elegans* or *Heterodera glycines*.

ISOLATION OF A GENE ENCODING A SECRETED MELOIDOGYNE ESOPHAGEAL GLAND PROTEIN. Ray, C., and R. S. Hussey. Department of Plant Pathology, University of Georgia, Athens, GA 30602-7274.

A monoclonal antibody specific for an antigen in the subventral esophageal glands and stylet secretions of both second-stage juveniles and females of *Meloidogyne incognita* was used to immunoscreen a random-primed cDNA expression library. The cDNA library was constructed from mRNA isolated from parasitic second-stage juveniles. Two positive clones were identified having cDNA inserts of approximately 2.3 kb and 2.2 kb long. Initial DNA sequence analysis indicated that the two inserts were derived from the same gene, which was named *sec-2*. In low-stringency genomic Southern blot analysis, the 2.3 kb *sec-2* cDNA insert bound to analogous sequences in *M. incognita*, *M. arenaria*, *M. javanica*, and *M. hapla*. No binding was observed to DNA from *Heterodera glycines*, *Caenorhabditis elegans*, or tomato. Preliminary analysis of the predicted amino acid sequence of 144 residues of SEC-2 protein showed that it was rich in leucine, phenylalanine, and histidine.

ENZYMELINKED IMMUNOSORBENT ASSAY (ELISA) FOR PASTEURIA NISHIZAWAE. Reise, R. W.,¹ T. A. Chen,² D. J. Chitwood,¹ K. J. Hackett,³ R. M. Sayre,¹ and R. N. Huettel.¹
¹USDA ARS, Nematology Laboratory, Bldg. 011A, Room 153, BARC-West, Beltsville, MD 20705, ²Department of Plant Pathology, Rutgers University, New Brunswick, NJ 08903, and ³USDA ARS, Insect Biocontrol Laboratory, Bldg. 011A, Room 214, BARC-West, Beltsville, MD 20705.

An ELISA-based procedure for quantifying the number of *Pasteuria nishizawae* endospores was developed with a monoclonal antibody generated in mice against a homogenate of *P. nishizawae*. The method could detect *P. nishizawae* obtained from *Heterodera glycines* cysts in concentrations as low as 1,600 endospores/ml. *Pasteuria penetrans* obtained from *Meloidogyne arenaria* also produced a detectable but somewhat weaker response in the ELISA. Absorbance values obtained during the procedure were near zero for samples of homogenates of uninfected *H. glycines* or *M. arenaria*. Three other bacterial species examined (*Bacillus thuringiensis*, *Streptomyces* spp., and *Escherichia coli*) failed to react with the antibody. A few problems with nonspecific activity associated with endogenous peroxidases in plant root samples were observed but were overcome by procedural modifications.

EFFECT OF MELOIDOGYNE ARENARIA POPULATION LEVEL AND MULCH TYPE ON OKRA. Ritzinger, C. H. S. P., and R. McSorley. Department of Entomology and Nematology, University of Florida, Gainesville, FL 32611-0620.

Organic amendments have often been used to manage plant-parasitic nematodes, but it is not fully understood whether the mode of action is suppression of nematodes by nematicidal effects or promotion of plant health by beneficial effects on soil, or both. Naturally infested microplots on sandy soil in Florida were blocked into low and high population levels of *M. arenaria* race 1

and planted with seedlings of 'Clemson Spineless' okra (*Hibiscus esculentus*). Mulch treatments consisting of perennial peanut (*Arachis glabrata*) hay, composted yard waste (mainly woodchips), or an unmulched control were applied to four replications at each population level. Nematode level and mulch type each affected yield ($P \leq 0.05$), which was highest in plots with perennial peanut mulch. Plant stands, gall ratings, and final nematode population densities were affected ($P \leq 0.05$) only by initial nematode level. Mulch treatments had no effect on final nematode population densities or gall ratings.

EFFECT OF TEMPERATURE ON EXPRESSION OF RESISTANCE TO *MELOIDOGYNE* SPP. IN CARROT. Roberts, P. A., and W. C. Matthews. Department of Nematology, University of California, Riverside, CA 92521.

Selected carrot genotypes were inoculated with eggs of *M. hapla*, *M. incognita*, and *M. javanica* and were maintained at constant soil temperatures of 22 C, 25 C, 28 C, 31 C, or 34 C. Root galling and egg production assays were used to determine resistance expression. Differential resistance expression was found among nematode species, for both level of resistance and resistance response to high temperature. Brazilia-derived genotypes were most resistant to *M. javanica*, but also were resistant to *M. incognita* and *M. hapla*. Reproduction on resistant genotypes increased at 28 C or at 31 C compared to lower temperatures, depending on genotype-nematode species combination. These results support our preliminary findings that carrot has several root-knot nematode resistance genes.

TOLERANCE TO *ROTYLENCHULUS RENIFORMIS* AND RESISTANCE TO *MELOIDOGYNE INCOGNITA* RACE 3 IN HIGH-YIELDING BREEDING LINES OF UPLAND COTTON. Robinson, A. F.,¹ C. G. Cook,² and N. Namken.³ ¹USDA ARS, College Station, TX 77845, ²USDA ARS, Weslaco, TX 78596, and ³Texas Agricultural Experiment Station, Weslaco, TX 78596.

Ten advanced breeding lines of Upland cotton (*Gossypium hirsutum*) were evaluated for lint yield production with and without 1,3-dichloropropene fumigation in a field infested with *Rotylenchulus reniformis* in the Lower Rio Grande Valley of Texas in 1992, 1993, and 1994. The susceptible control, Stoneville 453 (STV 453), yielded 739 and 400 kg/ha, respectively, with and without fumigation. Nine lines had higher yields ($P \leq 0.05$) than STV 453 with or without fumigation and lower estimated losses to *R. reniformis*. Four lines yielded 57-86% more lint than the partially resistant cv. LA RN1032. In growth chamber experiments examining LA RN1032 and six of the lines, all had *R. reniformis* population multiplication factors of >100, 10 weeks after inoculation; however, population densities increased more slowly on three of the lines than on STV 453. Three lines also were resistant to *Meloidogyne incognita* race 3, with a multiplication factor of <1.0, compared with 9.1 for STV 453 and 25.8 for root-knot nematode susceptible Deltapine 16.

REPULSION OF *MELOIDOGYNE INCOGNITA* BY ALGINATE PELLETS OF THREE NEMATOPHAGOUS FUNGI. Robinson, A. F.,¹ B. A. Jaffee,² A. C. Bridges,¹ and A. E. Muldoon.² ¹USDA ARS, College Station, Texas 77845, and ²Department of Nematology, University of California, Davis, CA 95616.

Columns (38-mm-d, 40 or 72 mm long) of sand (94% <250- μ m particle size) wetted with a synthetic soil solution (10-12% moisture) were used to examine responses of second-stage juveniles (J2) of *Meloidogyne incognita* race 3 to calcium alginate pellets of *Monacrosporium cionopagum*, *M. ellipsosporum*, and *Hirsutella rhossiliensis*. A layer of 10 or 20 pellets was placed 4 or 20 mm from one end of the column. After 0, 3, or 14 days, J2 were put on both ends, on one end, or in the center. Second-stage juveniles were extracted from 8-mm sections 1 or 2 days later. All three fungal pellets were repellent; pellets without fungi were not. Aqueous extracts of pellets and of sand in which pellets had been incubated were repellent, but acetone extracts redissolved in water